Fig. 1

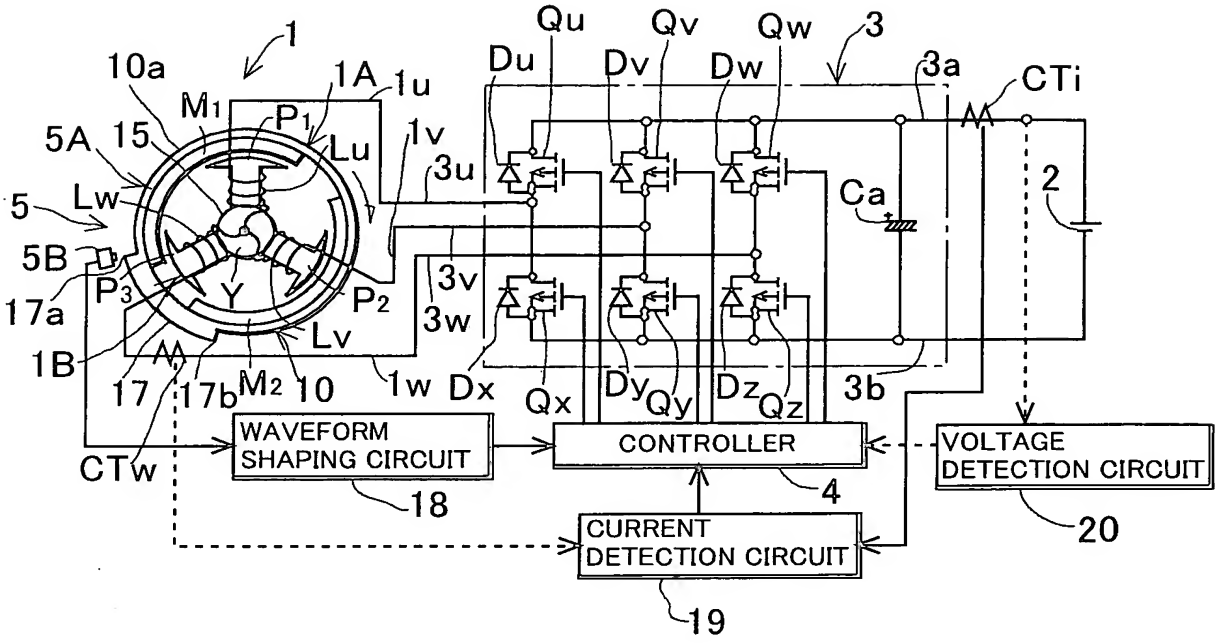

1
10a
1A
1u
M1
P1
5A
15
Lu
1v
3u
5
Lw
5B
17a
P3
Y
P2
3v
3w
1B
Lv
17
17b
M2
10
1w
Dx
Qx
Dy
Qy
Dz
Qz
3b
Qu
Qv
Qw
3
Du
Dv
Dw
3a
CTi
Ca
2
WAVEFORM SHAPING CIRCUIT
CONTROLLER
VOLTAGE DETECTION CIRCUIT
CTw
18
4
20
CURRENT DETECTION CIRCUIT
19

Fig. 2

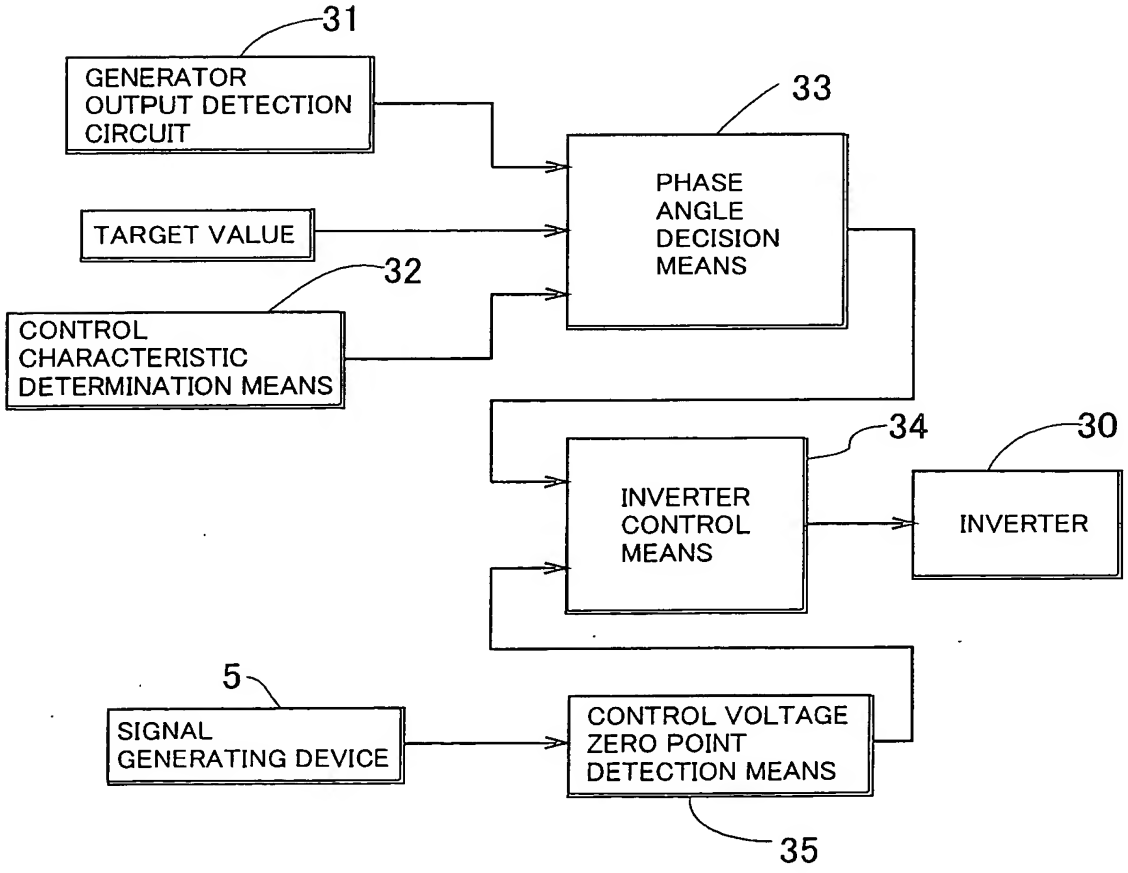

31
GENERATOR OUTPUT DETECTION CIRCUIT
33
PHASE ANGLE DECISION MEANS
TARGET VALUE
32
CONTROL CHARACTERISTIC DETERMINATION MEANS
34
30
INVERTER CONTROL MEANS
INVERTER
5
SIGNAL GENERATING DEVICE
CONTROL VOLTAGE ZERO POINT DETECTION MEANS
35

Fig. 3

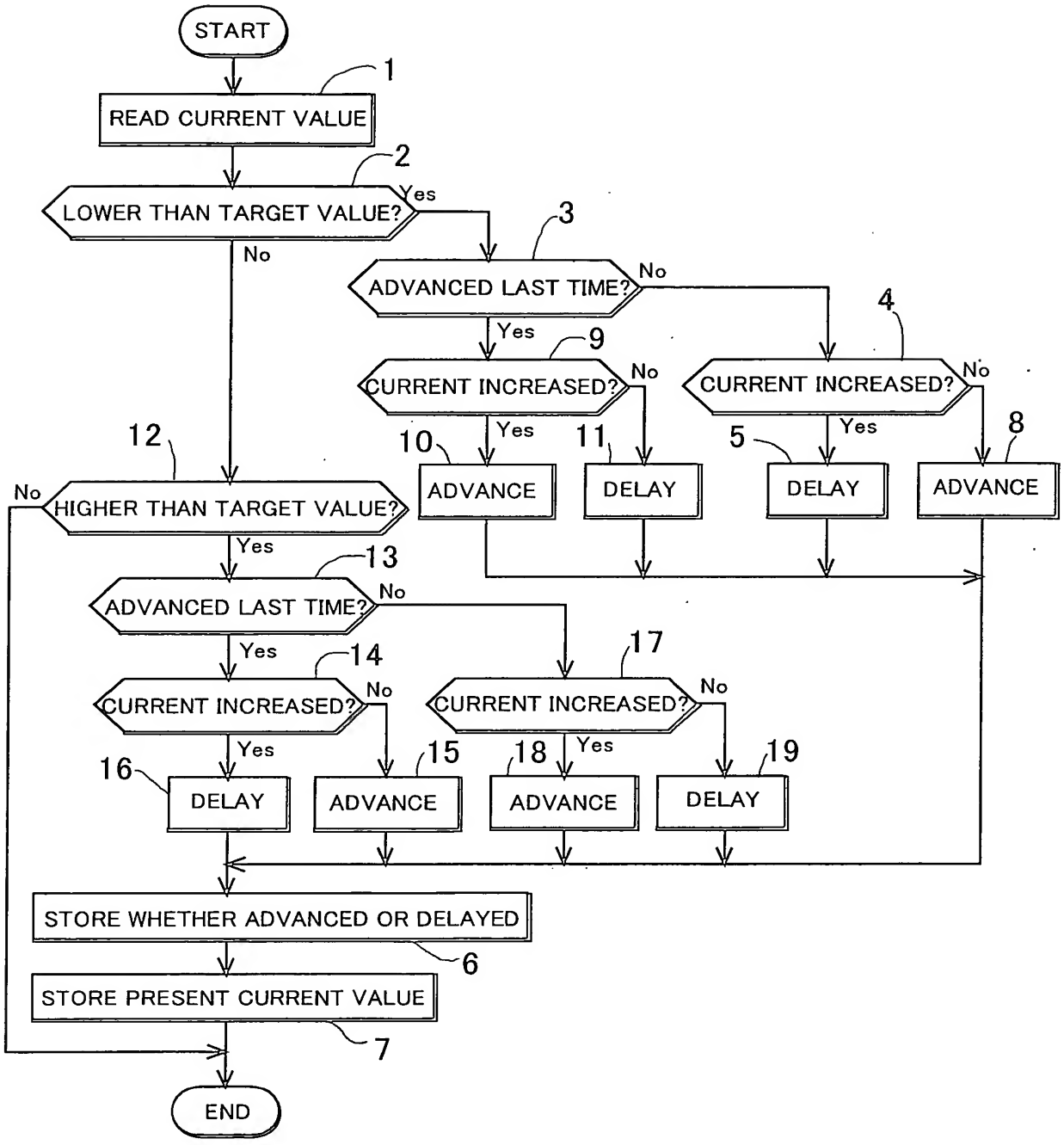

START
1
READ CURRENT VALUE
2
LOWER THAN TARGET VALUE?
Yes
No
3
ADVANCED LAST TIME?
No
Yes
4
9
CURRENT INCREASED?
No
CURRENT INCREASED?
No
Yes
Yes
12
10
11
5
8
No
HIGHER THAN TARGET VALUE?
ADVANCE
DELAY
DELAY
ADVANCE
Yes
13
ADVANCED LAST TIME?
No
Yes
14
17
CURRENT INCREASED?
No
CURRENT INCREASED?
No
Yes
Yes
16
15
18
19
DELAY
ADVANCE
ADVANCE
DELAY
STORE WHETHER ADVANCED OR DELAYED
6
STORE PRESENT CURRENT VALUE
7
END

Fig. 4

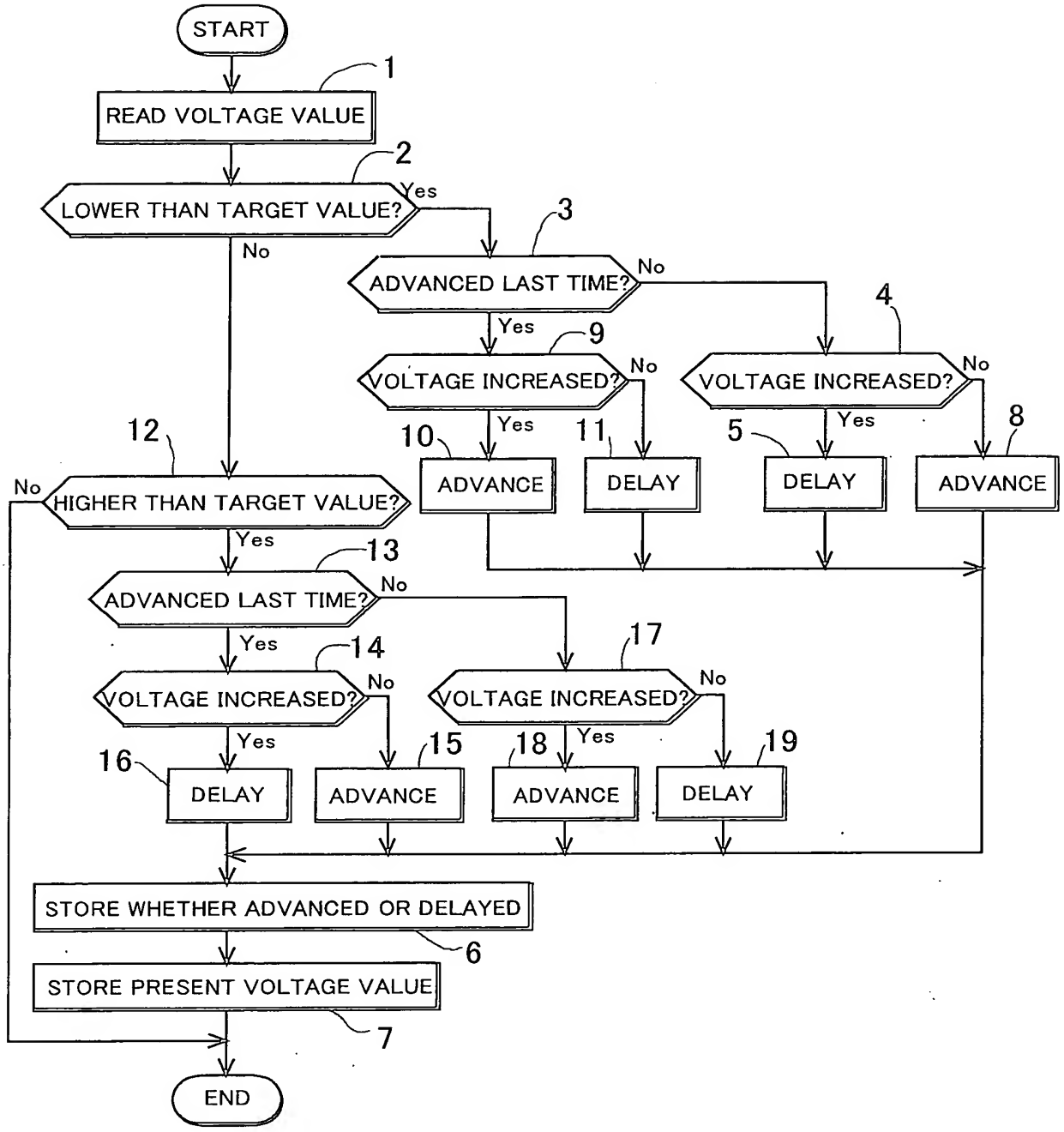

START
1
READ VOLTAGE VALUE
2
LOWER THAN TARGET VALUE?
Yes
No
3
ADVANCED LAST TIME?
No
Yes
4
9
VOLTAGE INCREASED?
No
Yes
VOLTAGE INCREASED?
No
Yes
12
10
11
5
8
No
HIGHER THAN TARGET VALUE?
ADVANCE
DELAY
DELAY
ADVANCE
Yes
13
ADVANCED LAST TIME?
No
Yes
17
14
VOLTAGE INCREASED?
No
VOLTAGE INCREASED?
No
Yes
Yes
16
15
18
19
DELAY
ADVANCE
ADVANCE
DELAY
STORE WHETHER ADVANCED OR DELAYED
6
STORE PRESENT VOLTAGE VALUE
7
END

Fig. 5

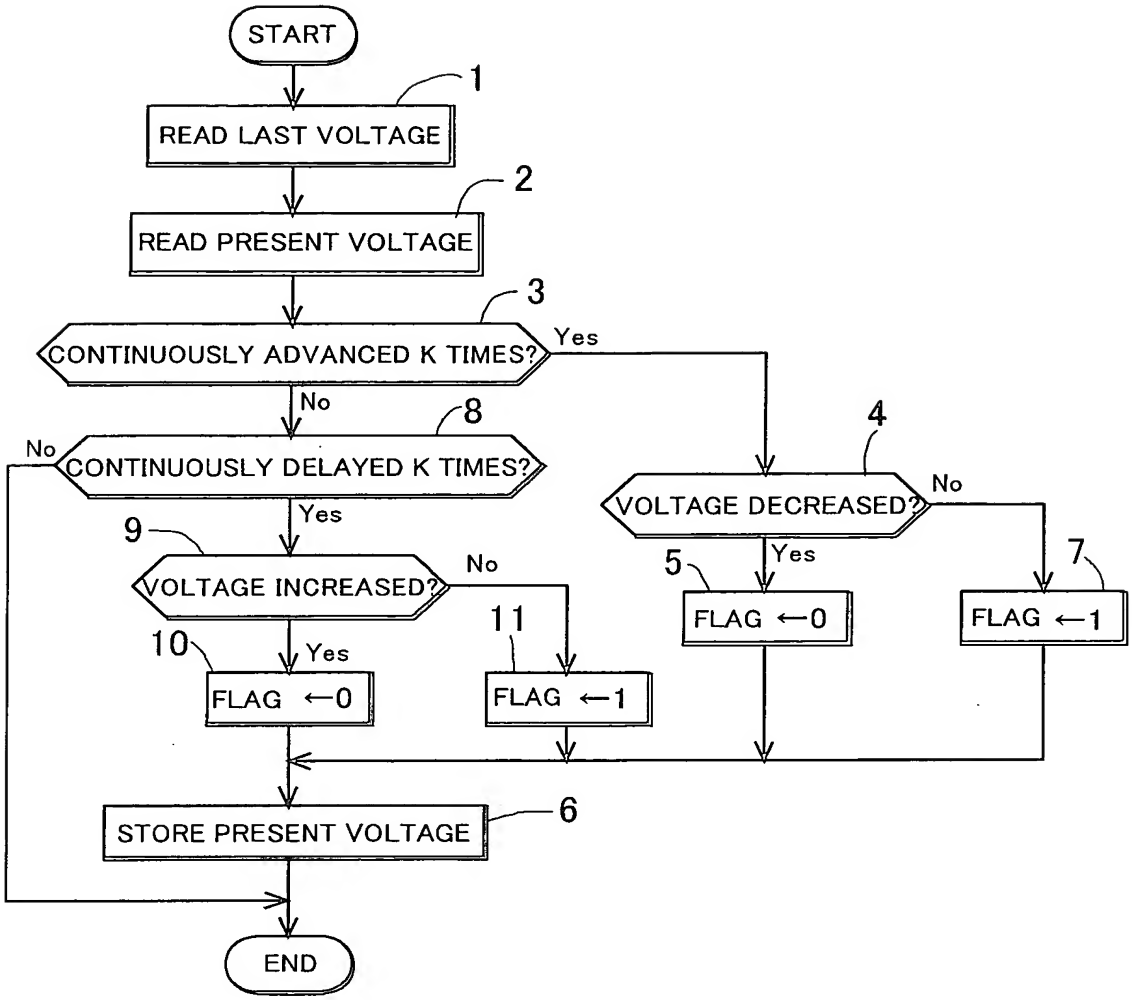

START
1
READ LAST VOLTAGE
2
READ PRESENT VOLTAGE
3
CONTINUOUSLY ADVANCED K TIMES?
Yes
No
8
No
CONTINUOUSLY DELAYED K TIMES?
Yes
4
VOLTAGE DECREASED?
No
Yes
9
VOLTAGE INCREASED?
No
5
FLAG ←0
7
FLAG ←1
11
10
Yes
FLAG ←0
FLAG ←1
STORE PRESENT VOLTAGE
6
END

Fig. 6

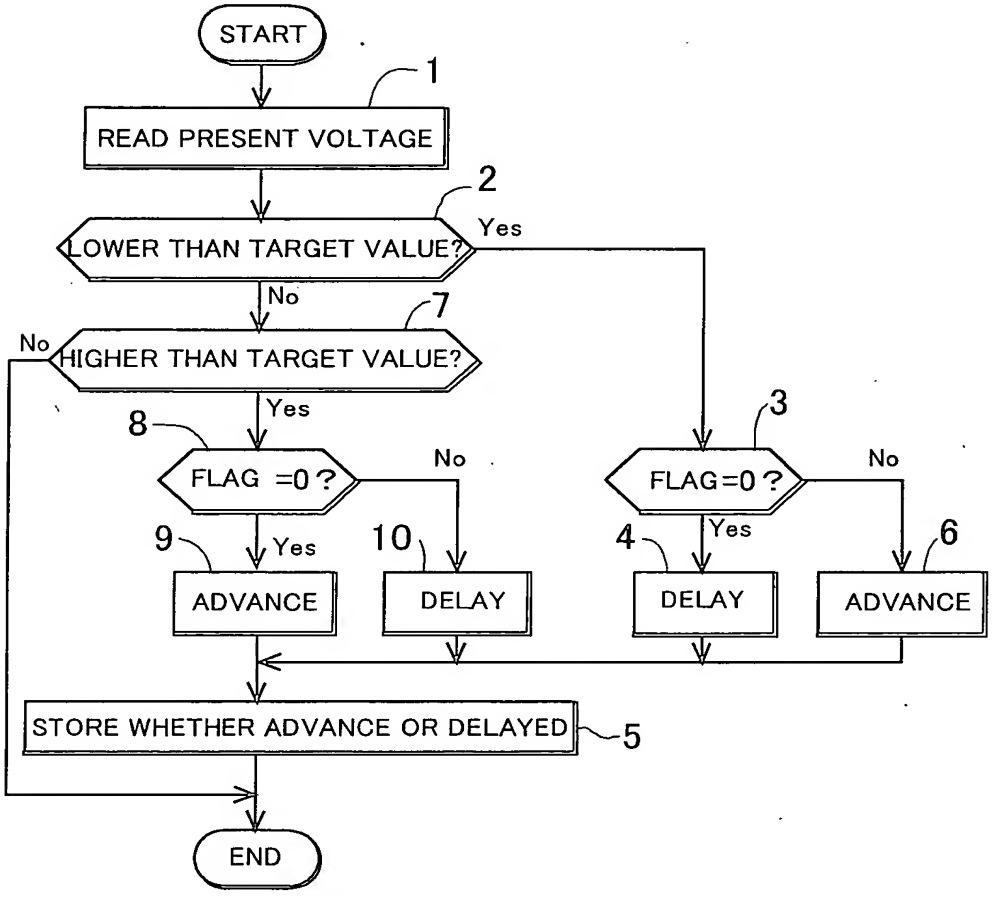

START
1
READ PRESENT VOLTAGE
2
LOWER THAN TARGET VALUE?
Yes
No
7
No
HIGHER THAN TARGET VALUE?
Yes
8
FLAG =0 ?
No
3
FLAG=0 ?
No
9
Yes
10
4
Yes
6
ADVANCE
DELAY
DELAY
ADVANCE
STORE WHETHER ADVANCE OR DELAYED
5
END

Fig. 7

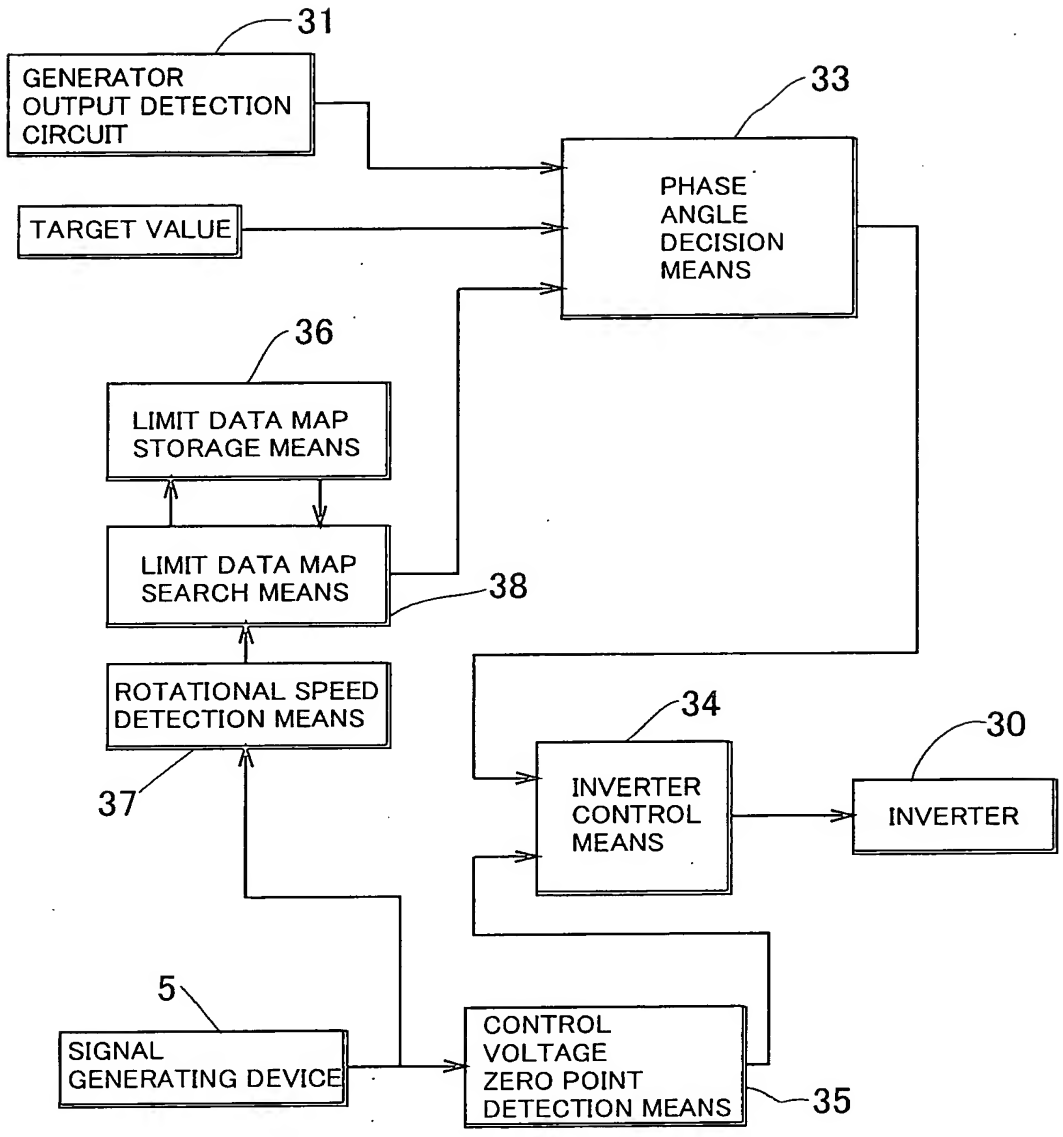

31
GENERATOR OUTPUT DETECTION CIRCUIT
33
TARGET VALUE
PHASE ANGLE DECISION MEANS
36
LIMIT DATA MAP STORAGE MEANS
LIMIT DATA MAP SEARCH MEANS
38
ROTATIONAL SPEED DETECTION MEANS
37
34
30
INVERTER CONTROL MEANS
INVERTER
5
SIGNAL GENERATING DEVICE
CONTROL VOLTAGE ZERO POINT DETECTION MEANS
35

Fig. 8

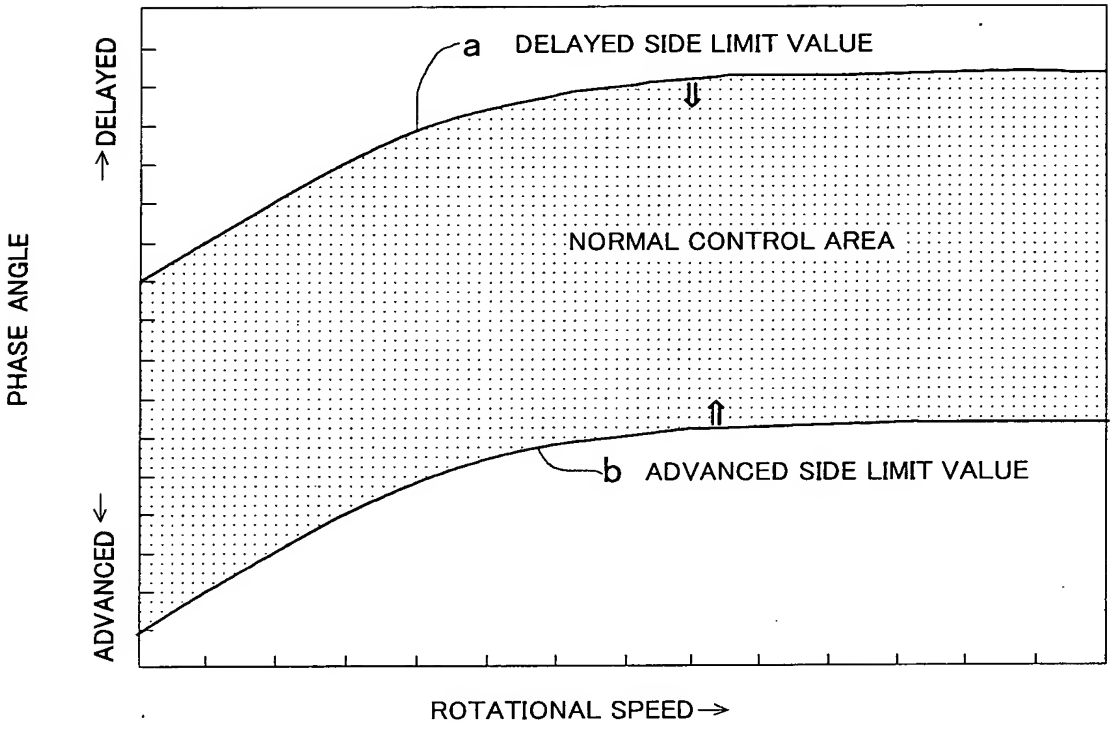

a
DELAYED SIDE LIMIT VALUE
→DELAYED
NORMAL CONTROL AREA
PHASE ANGLE
b
ADVANCED SIDE LIMIT VALUE
ADVANCED ←
ROTATIONAL SPEED→

Fig. 9

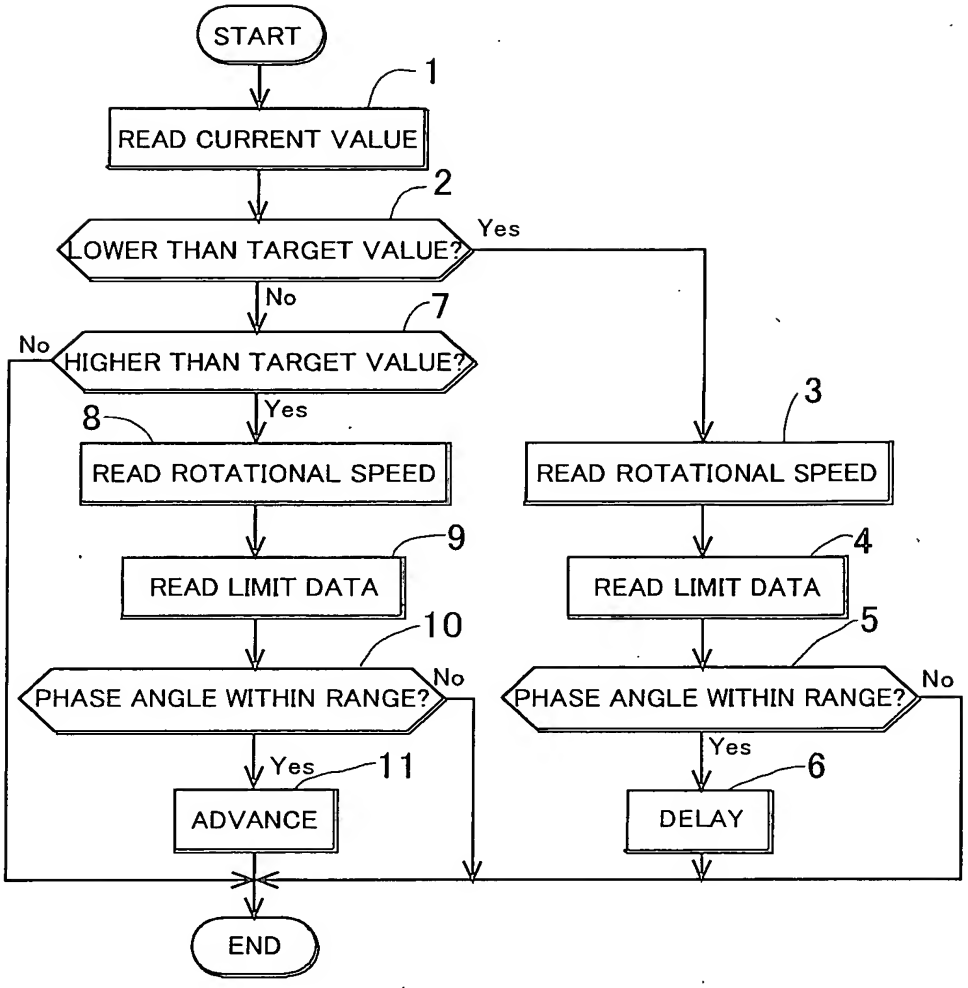

START
1
READ CURRENT VALUE
2
LOWER THAN TARGET VALUE?
Yes
No
7
No
HIGHER THAN TARGET VALUE?
Yes
8
READ ROTATIONAL SPEED
9
READ LIMIT DATA
10
PHASE ANGLE WITHIN RANGE?
No
Yes
11
ADVANCE
3
READ ROTATIONAL SPEED
4
READ LIMIT DATA
5
PHASE ANGLE WITHIN RANGE?
No
Yes
6
DELAY
END

Fig. 10

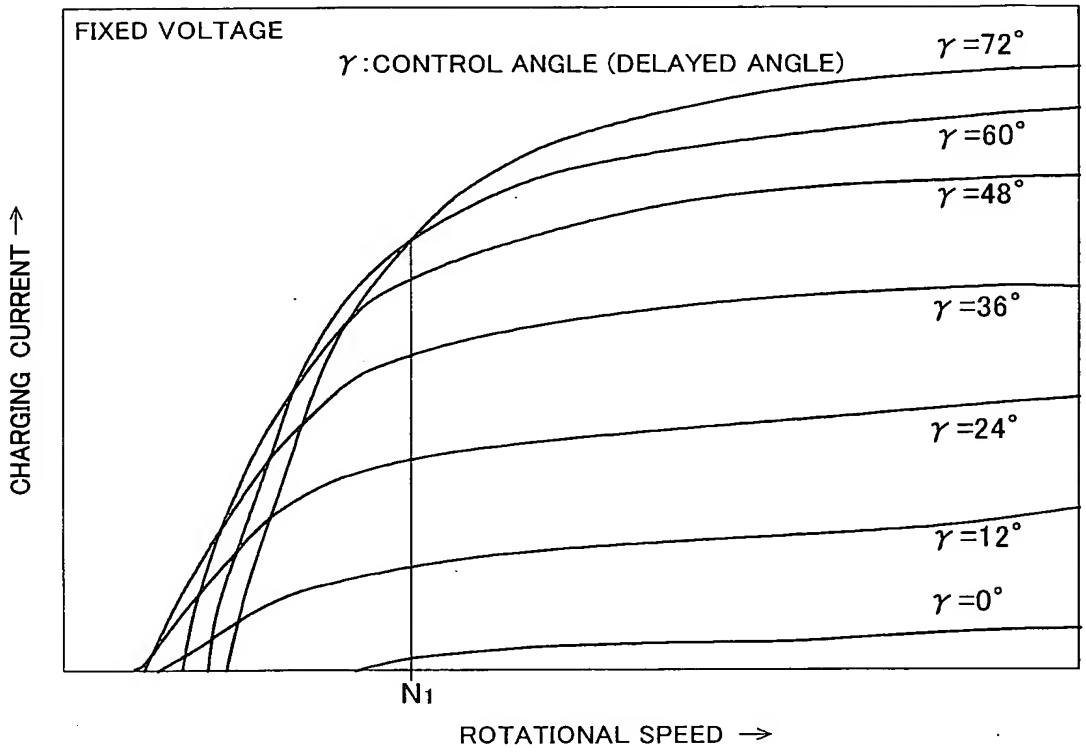
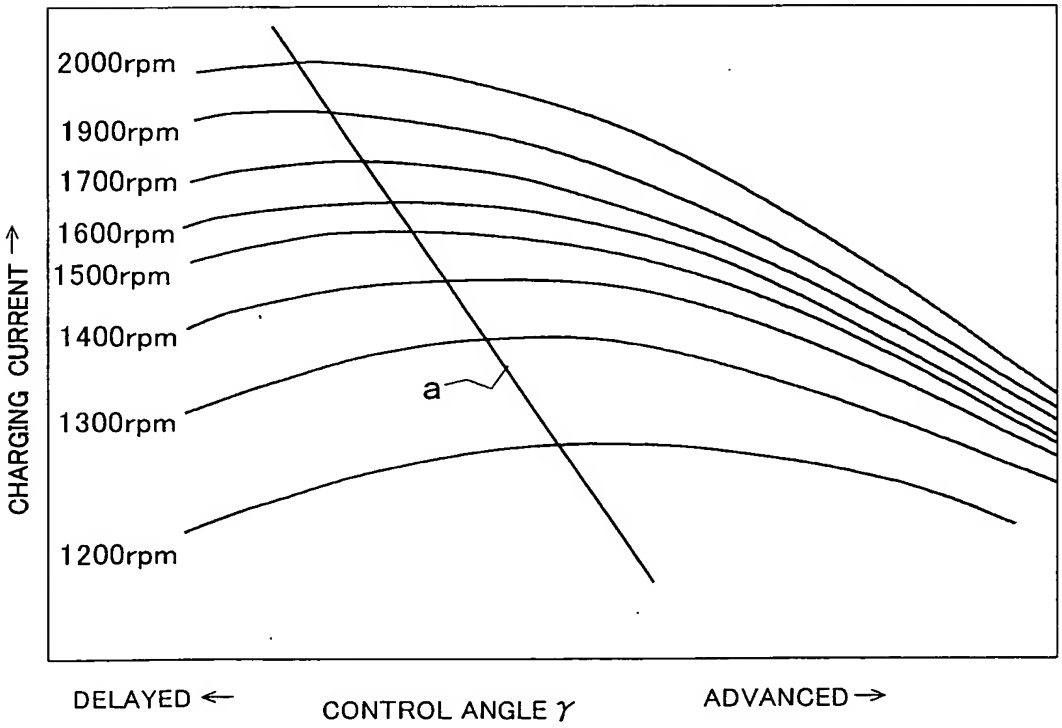

FIXED VOLTAGE
γ:CONTROL ANGLE (DELAYED ANGLE)
γ=72°
γ=60°
γ=48°
γ=36°
γ=24°
γ=12°
γ=0°
CHARGING CURRENT →
N1
ROTATIONAL SPEED →

Fig. 11


2000rpm
1900rpm
1700rpm
1600rpm
1500rpm
1400rpm
1300rpm
1200rpm
a
CHARGING CURRENT →
DELAYED ←
CONTROL ANGLE γ
ADVANCED →